Notebook, N-04-10-15

This notebook was used by Edison during October 1904. The book contains notes and drawings regarding storage batteries. Included is a list of possible causes for the loss of capacity by the cells. Also included are cost calculations for production of the battery and schematic drawings of the manufacturing layout. The pages are unnumbered. Approximately 40 pages have been used.

NH_3

40 | 27000 (85.66lb
320 | 23600
1400

80
48 | 240 (5
16 = | 80 (
378

180 | 2000
360

3 | 48
16

124 | 1320 (10.64
124
800
744
56

24 | 180 (7 | 600 (
168 | 86 (

45
45 (c

200 | 9000
800
1000

275
50
90
64
50
2
229

25

86 lb
86
4
344

220
175
395

344
80
275 2

40

2

64
50
512

50
8
400
400
40

5.16
10.96
4.15
21.06
7.50
1.00
5.00
2.14
7.95
12.00
1.10
20.00
2.40
0 036

167.95

05000
00150
05150
516
703

00168
00416
01560
0214

00412
03500
03590
00500
0795

18 plate

Mix Mixture 1.00

Stock Can	5.16 Cents	
Separator	10.96 "	
Filler	4.15 "	
Grid	21.06 "	
Cups	7.50 "	
Neg @ 00 pole + Conty rod	"	1 Cent
Spacer washer	.054 "	
Split washer + clamp nut + pole nut		.0214 Cents
Conty wire lugs, terminal wire lugs		.0795 "

0365
00168
00140
00012
00060
00056
04154

0410
0040
0066
0516
05000
00165
5.65
009
5

0435
0018
0445
0045
0108
0045
10.96

16795
1200
15595

0175
0175
0850
1200

00220
00019
00012
00251

Jack body screw & handles .00251

~~Cell Superior 12 cents~~

Socket wrench .011 cents
Filler Can 20 cents
" Hose 24 cents

KOH $1.55 95

Tray

Solder

filler

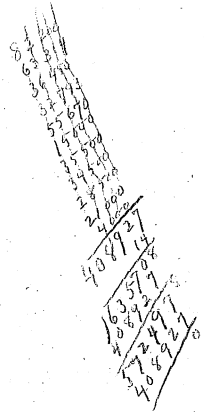
Pkg

10
16
25
41

20 | 100 (5

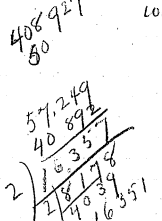
6 | 3500 (291
200 | 5800
4800
1900
3

Mrs	1,00,
Stock	1 00
Rubber	80
Tray	20
Filter	5
Kbth,	5
Pkg	15
	325
	291
	616



408927
50

Sum 8178
Carlson 4089
2018
2018
16253



E 45

Theories as to the reasons

Why a set of cells all of which test high will after 2 months use show great changes in ampere capacity

1st Plates are so close that vibrating contacts take place while charging so they do not get full charge possibly same occurs to lesser extent on discharge - possibly excessive gasing working explosively (ie) in gusts or big bubbles vibrates the plates + make momentary contacts. To detect these vibrations listen by a stethoscope placed on side of Can - 2nd way shunt a cell with high resistance primary & listen with Telephone in secondary to hear sizzling of contacts

2nd As there is considerable graphite on outside of plates in the perforations which was off - This graphite may by gas boiling make momentary contacts, across the bottom rubber or where the plates have got very close together the graphite going to the top + then subsiding would in time fill up a part of pocket that was very close + while not making an arc would make a high resistance short circuit The original preliminary washing of the cells does not remove the graphite from the perforations — Perhaps there may be other places where the graphite flakes can build over — By listening to telephone or stethoscope, or in a very dark room + high charge cured when top was taken off look down for sparks — but in case of high resistance circuit this would not show —

3 = Mercury iron filiments by Electro deposition grow across cells — this was found in one cell taken apart, None found

4th — Iron dissolved in the KOH may get sulphurized on the surface of the Rubber + Conduct — Lead foil is used to polish rubber possibly Sulphur acts to make it a conductor or it becomes peroxide of lead and makes high resistance circuits,
Chemical Rubbers - did no good

5 Are the E45 from Gibbs wagon got rubber sep between the nickels —
Was Ni filled before or after was got even filled plate. = open

7 To prove cross or high resistance: One E 45 should be taken apart, washed & assembled as two E 18 putting all the low swell in one cell a high swell in the other

8= also one 2 45 showed have KOH poured half out + balance shook up to dislodge + wash out any grafite particles that became lodged between + then poured out + new KOH put in + chgd 24 + also — dubious good

9 another cell showed have KOH poured out + distilled water put in + soaked couple hours + poured out + this kept up. till water poured out showed I calcedy any KOH then had battery for Resistance with no water in if there is a conductive grafite arc we will catch it —

No good

10 = possibly can see through the filler hole in the chk of sparks given off under liquid —

11= Uneven crimping & the gradual swell after 1st test has caused bad contacts with Nickel-
as rewind cell came back this might be so

12 = Cells which are now low perhaps my parties permitted water get low in these cells and when has heated & driven Hg out & iron is low
iron tested out good

13 = Rubber unequally treated & more sulphur in one than another cell & in time this comes out & affects the iron = Grow OK

14 = foaming of cell causes float graphite to go up against shields bleeding thus can a plastered over on both giving a high Res circuit this may be cause of exploding some cells possibly

15 = The swelling of the Edges of pockets is very unequal. - if they hold well the swell is small if they do not hold well the swelling is great + this variation of swelling must have a powerful influence on the Contact with the Hi mix along the Whole face — if the Edge holds the mix there is forced out to the Center + the Center swells — if the Edge dont hold well there is a slip + if on one side that side gets a poor Contact therefore the Crimp should hold — possibly the failure to hold is due to shallow inside corps —

6 = The mat on top cell (the) the rubber has a lead surface I think possibly high Resistance here —

possibly

7 = Possibly water gets low —
KOH Concentrates at bottom
of cell swelling lower pockets
(10) lower ends of each pocket
all way up so there is a
bad contact on mix —
No!

8 Will reversing the nickel
bring a bad cell back —
possibly in many cases
Reversing with heavy current
only dislodges flakes of
graphite between swelled pockets
& removes high resistance
short ckts — or globules
of Hg just on verge & which
short ckt —
Saw long globule Hg &
stuff at bottom of cell dangerously
near bottom plates
Reversing at factory to clean
will stop this —

Making Can by plating

1st Make plaster paris small can 1/2 size varnish with asphalt in Benzol or graphite & put in Rufus plater

2nd Make thin brass cell 5/1000 solder it - to plate cross & clouds remove brass by unsoldering

3rd Make an Experiment of pouring lead in a brass cup or quickly pour it out see if shells do also get some type metal try if ok make Cell possible mixed + use type metal also possible Zinc fusible metal etc. Amalgam —

~~possible, [illegible] outside~~
~~dip in type metal~~ dip in type metal

Citrate ~~[illegible]~~ a gum
when [illegible] in [illegible]

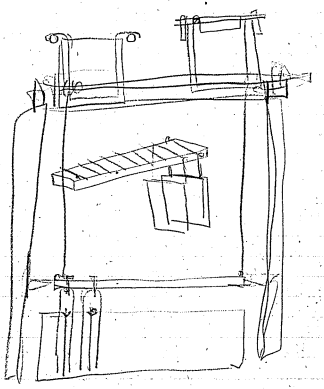
Citric a Sol Alcohol
Phthalic a "
NH_4Cl [illegible] sufficiently
Sol Alt
NH_4NO_3 Sol Al
Benzoic acid
Borate K sol Al
Camphor,
Naphthalene in Benzol

Oct 28 1904

Think the MoOH dry can be soaked in water & then put in tumbling bbl. graphite put in without any of the graphite becoming coated with Mo

Possibly MoOH, 60 mesh put in tumbling bbl with Ammonia ~~[illegible]~~ vapor passing in ~~[illegible]~~ with the graphite which could surface nickel to stick to graphite ok -

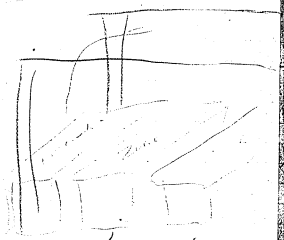
perhaps tightening up screws on connections works pitches & causes like cells to short ckt, see Mallory



60 - 40
1000
1500

160 -

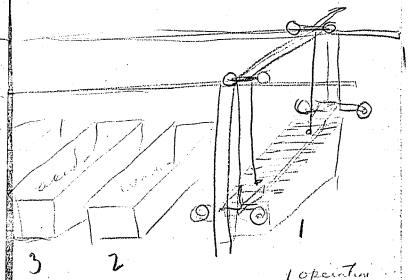
2



20 lb
14
100) 2500 (17
100
1500
1470
50 plates —

4 Jankogatons,

8 men —
4 Satin
2 trays



1 operation
26 minutes
48 in 24 hours

1	150
2	240
3	480
4	240
5	150
6	150
7	150
	1560

60) 1560 (26
120
360

12 lb =

$\frac{2.5}{5}$

230.7

$\frac{32}{3}$

64

230 / 446 (1

11.

100. 5 days $\frac{1}{1000}$ =

~~500 days~~ or 1 ft. $\frac{1}{10}$ wide

14.4 $\frac{25}{5}$ / 14.4 (4. lb –

150 dips
2.5 cc to packet (fold)

150 dips
25
750
300
37.5

150
25
750
200
3750 cc

200 cc

1200 cc

20 pkts 3 sq inches - 150
1/5 - products 1 lb
30 milq to dip
86 dip
10 hours - 30) 2000 (86
240
22 - packets 3 sq inches
180) 7746 (43
720
546
446000
125
2230000
892000
446000
557500

1728) 27-

446
5500
2772
1446
490537
500
500
5500 milq

180) 5500 (30.
540
100

Experiment on Battery
Oct 15 1904

1 = Make Iron with 20% (30 40 & 50%) Copper (metallic) + Req amount of Hg — first make iron then Copper ammonated, then wash + dry then mix HgO — & make variations as to amount of Copper — also try instead of Copper use Bismuth oxide & HgO, mixed with the Iron — also vary this, The idea being to have the Copper or Bi hold the Hg in place as an amalgam instead of Fe is oxid & thus give good contact to last remnants of the metallic iron — (Vary the Hg)

2 = Carry heat higher & reduce the iron to bright non pyrophoric state using HgO in mixture Req amount,

3=Try an old Ni that has gone bad-dry
Hot press with thick rubber to
make cup hug the irregularities
of the Nix + then brush good
Contact back —

4=Make an iron with 20% B_2O_3
mixed with it instead H_2O —

5=Make Iron by heating Ferrous
Sulphate with Molten KOH.
Reduce H, Reg + high to get
Pyro iron — with a-dehydrated
H_2O - to get Voltage to see if KOH
removes any impurity that gives
high Voltage and charge
also treat the oxide after
washing with Hydro also
with fused Nitrate KOH to
get Manganese out,

6 = Make some Iron by Electrolysis from Ferrous Sul & Nitry - hat same as Rafin uses get 1/2 lb — then dissolve in CP Sulphuric & replate at lowest density possible, just so iron deposited and no metal higher in the series - then dissolve in Sulphuric CP & form Oxalate ignite & Red in H Reg use Hg & well out, by using a very low density can remove most of Manganese & Cerium,

7 = Make a iron amalgam by the Current then agitate with air to Oxidize the Manganese & Cerium & metals higher than the iron & distill the Hg in Vacuo also air & oxdy if necessary by Hypo —

8 = Has the H_2O_2 anything to do with high charging voltage if H_2O_2 being used in KOH —

9 = ~~Take~~ Charge a small cell in Reg KOH & instantly remove to 45% KOH & discharge —

10 Chg small cell in 5% & instantly remove to 45 per cent & discharge - These experiments show give some clue to Voltages due to concentration

11 = Charge small cell in 45% & instantly charge & discharge in Reg 20% —

12 = Make some indurana cells with new die with short pocket,

13 Make Reg pockets but after final Corrugation press with Rubber at higher pressure than Corrug or plane press to make pocket of pitt to follow contour of the nickel screen

14 In a test cell charge and at same time add + connect to the 7c Elec a large surface of plain cup to see if larger plain surface increases the charging voltage, also when it is sulphatized —

15 Catalyzers to mix with Iron
Using H_2O_2 + possibly Copper – Cobalt hydrox
Cerium – Uranium, Bismuth, Silver, Cobalt
Platinum, Tin, Antimony + ~~[illegible]~~ Nickel
Carbon, Silicon, Nickel hydrox
In Electrolyte Zinc Tin Sb, Lead
Aluminum, K_I Na Cl, Br, NH4 as K_2SO_4
Magnesium Hydroxide, Bismuth hydroxide
Ba, Ca, Sr, Tellurium, Arsenic, Selenium
SO_4 – + other stable acid radicals

16 = Fridell make a good pocket with using Tain Calliper for iron using 2.4 iron instead of 4.8 to see if circulation is better + Charging Voltage better,

17 Use porous partition + put Ni in 40% KOH + Fe in 1% KOH + charge + get Voltage Curves — Then Reverse the operation, Chge in above + disch Ni in 1% + Fe in 40% — also charge Ni in 1% + Fe in 40 to see what Carbon changes in the place —

18 — Charge + disch Reg Little Cell in 5% another 10% another 15% — another 25 another 30% another 35% + one at 45% to see Chg + disch Curves —

19- Do the same in NaOH,

20- Do the same as 18 with 2 parts Chloride K in of the percent of KOH - ditto 4 parts

1 = Soak group hot distilled H_2O before using Rev'd prep.
2 = get 1/2 dry gibbs & clays — Group KOH or alkali just water
3 Group Reg Rev'd prep — Boil in 1% KOH 15 hours
4 = The first group poor cell break water dell KOH out
+ boil 2½ changes again, then soak 12 hours + put to work
5 = [illegible] unemployed check [illegible] 3 agitts,
6 = Clay in specie then weak dell MnO_2 & Cinch, sun + dry
7 = well wash group Tibbs pkts, put in Reg Group —
dell Group in Reduced Group 2 —
8 Run group in saturated Barium Oil, Then change to 2½% —
9 = Run group in 2 grams Gelatin —
10 " 2 " Albumen —
11 Reduce some Tibbs in KOH with Hyposulphite K or Na Shaking
granules — also, dissolve in NH_4HCl dec of whole lime left —
also in weak acid — etc —
11 = group with C cups Reversed,
12 " " with 3 grams Albumen —
to see if 1st clay bad.
13 group with 3 grams Sulphite K or Na
14 " " 3 " Tannic acid
15 " " 3 Molasses
16 " " 3 Sugar
17 " " 3 Oxalic acid —
18 " Some Hard Rubber or [illegible] Cy H_2O_2 also Hot Kalchlorate,

960
14
360
960
1344

24.00
9.62
9.20
9.60
1.54

466
24
1944
932
934
1.1.30
42

34.5 | 600 (17.5
345
2600
2415
185
24

17.5
28
200
140
25
20
350
3
4.8.6.5

11.6
14
464
116
1.6.24

14
13.30
39

13.14
1.26